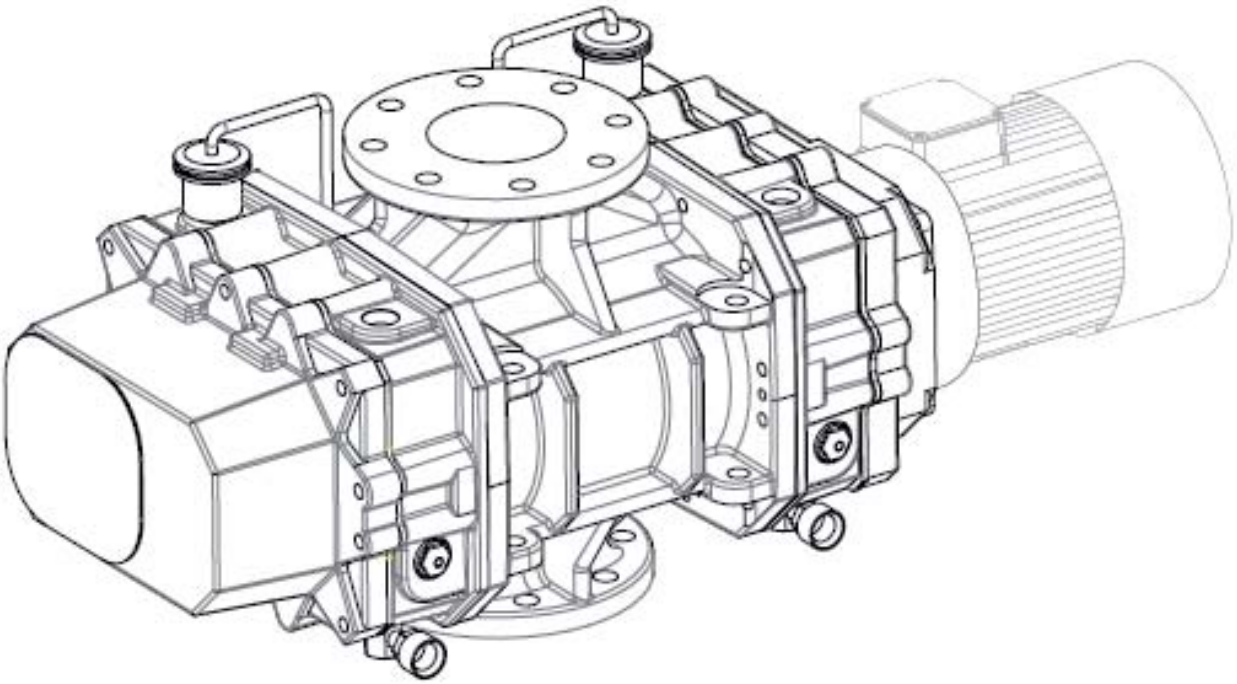
ROOTS 1002 / 1502

POMPES ROOTS
ROOTS PUMPS



Manuel de l'Utilisateur
User's Manual

adixen
by Alcatel Vacuum Technology

Realization/Publication: Alcatel Vacuum Technology France - User's Manual - Ed 01 - Date: 01/1999 - Part Number: 107342

Alcatel Vacuum Technology, as part of the Alcatel-Lucent Group, has been supplying vacuum pumps, helium and hydrogen leak detection systems, plasma sensors, vacuum measurement for several years.
Thanks to its complete range of products, the company has become an essential player in multiple applications : instrumentation, Research & Developement, industry and semiconductors.
Alcatel Vacuum Technology has launched Adixen, its new brand name, in recognition of the company's international standing in vacuum position.
With both ISO 9001 and 14001 certifications, the French company is an acknowlegded expert in service and support, and Adixen products have the highest quality and environmental standards.

With 45 years of experience, AVT today has a worldwide presence, through its international network that includes a whole host of experienced subsidiaries, distributors and agents.
The first step was the founding of Alcatel Vacuum Products (Hingham- MA) in the United States, thirty years ago, reinforced today by 2 others US subsidiaries in Fremont (CA) and Tempe (AZ).
In Europe, AVTF-France headquarters and its subsidiaries, Alcatel Hochvakuumtechnik (Germany), Alcatel Vacuum Technology UK (Scotland), Alcatel Vacuum Technology Benelux (Netherlands), Alcatel Vacuum Systems (Italy) and more recently Adixen Sensistor AB in Sweden (in 2007) form the foundation for the European partner network.
In Asia, our presence started in 1993 with Alcatel Vacuum Technology (Japan), and has been strengthened with Alcatel Vacuum Technology Korea (in 1995), Alcatel Vacuum Technology Taiwan (in 2001), Alcatel Vacuum Technology Singapore, Alcatel Vacuum Technology Shanghai (China) (in 2004).
This organization is rounded off by more than 40 represensatives based in a variety of continents.
Thus, whatever the circumstances, the users of Adixen products can always rely on quick support of our specialists in Vacuum Technology.

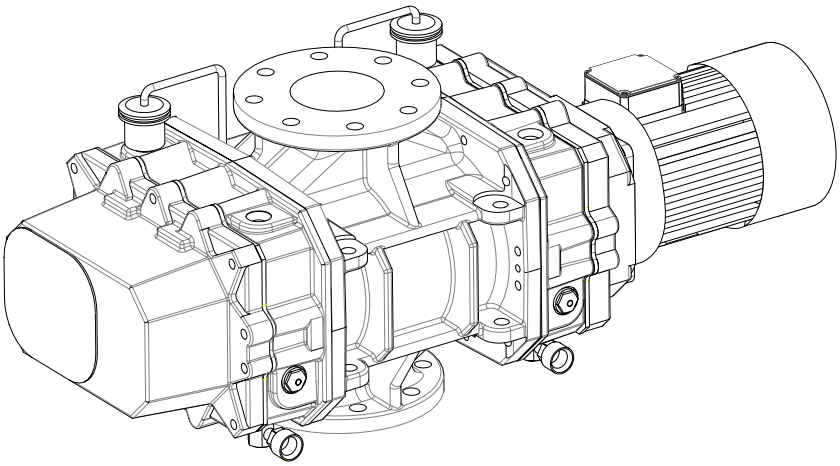
Gb 0779 · Edition 04 · Feb 2008

1002 / 1502 ROOTS pumps

Dear Customer,

you have just purchased an Alcatel Roots pump. We thank you and are proud to include you in our customers.

This product has benefited from Alcatel's many years of experience in dry pumping.



For optimum performance and to obtain full satisfaction from this equipment, we recommend that you study this manual before any intervention on your pump, in particular, the chapter on installation and start up.

APPLICATIONS:

- Pumping of gases with few water vapor:
  Pumping of large volumes - Metallurgy - Space simulation - Packaging - Lazers - Lighting - Gas conditioning - Research and Development

- Condensable vapors pumping:
  Plastic chemistry - Drying - Vacuum impregnation - Nuclear industry - Cosmetics - Cleaning - Freeze-drying - Gas conditioning - Research and Development

ADVANTAGES:

Quality and reliability - Low noise - Canned motor concept - Vacuum integrity - Resistant to process gases and condensables - Simplified maintenance - Air cooled

MANUAL REFERENCE : **107 342**
EDITION : **01 - January 1999**

Edition 01 - januany 99

Contents

User's Manual
Roots 1002 / 1502

Introduction
- Pump introduction . . . . . *A 10*
- Roots pump operating principle . . . . . *A 20*
- Technical characteristics . . . . . *A 30*
- Accessories . . . . . *A 40*

Start-up
- Safety instructions . . . . . *B 10*
- Unpacking / Storage . . . . . *B 20*
- Positioning the pump in the pumping installation *B 30*
- Filling the machine oil housings . . . . . *B 40*
- Power supply connection . . . . . *B 50*
- Checking the direction of rotation and initial pump start-up . . . . . *B 60*

Operation
- Roots operation . . . . . *C 10*

Maintenance
- Safety instruction related to maintenance . . . . . *D 10*
- Maintenance frequency . . . . . *D 20*
- Diagnosis and troubleshooting . . . . . *D 30*

Maintenance sheet
- Roots pump draining . . . . . *E 10*

Appendix
- Pumping curves . . . . . *G 10*

Edition 01 - january 99

Pump introduction

The Alcatel Roots Pumps are suited to a wide range of vacuum applications. In combination with primary vane pumps, or dry pumps, they achieve low pressures with high pumping speeds.

Alcatel quality and reliability

Without any mechanical contact, and proven in industrial and chemical applications, the Alcatel Roots pumps achieve high reliability.

Canned motor concept

The motor armature and drive shaft are enclosed in a vacuum tight “can“, this design eliminates external shaft seals and potential leaks.

Resistant to process gases and condensables

The careful choice of quality components makes Alcatel Roots well adapted to aggressive environments.

Aggressive environments require vertical flow Roots, to prevent condensate from accumulating inside the pumping chamber.

Simplified maintenance

“On-site“ maintenance capability.

Low noise

Compact design, quiet operation, low vibration level.

Air cooled

Vacuum integrity

The RSV Series is Helium leak tested to < 1.10^{-7} mbar l/s and is ideally suited for hazardous or precious gas transfer.

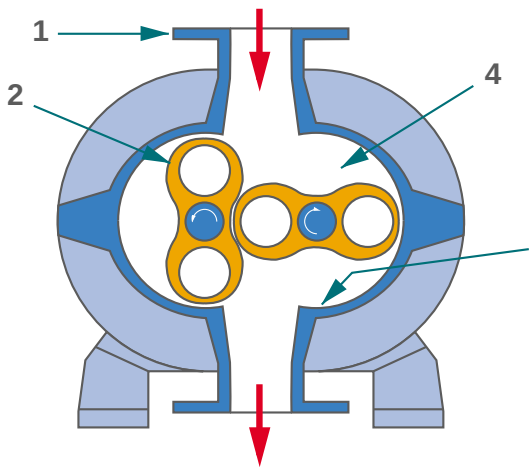
Edition 01 - January 99

ROOTS pump operating principle

Rotating-piston pump principle

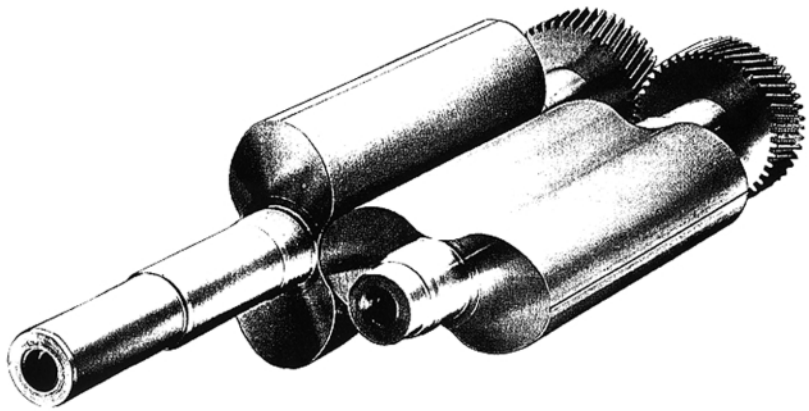
Two identical-shaped rotors turn in opposite directions in the casing, without touching each other or the casing.
The two rotors have a figure-8 shaped cross-section, and are synchronised by a gear drive. The play between the pistons and the casing is of a few tenths of a millimetre.

Transverse section of a one-stage synchronous twin rotor pump



1 -Inlet flange
2 -Rotor
3 -Inner wall of the casing
4 -Pump chamber (developped volume)

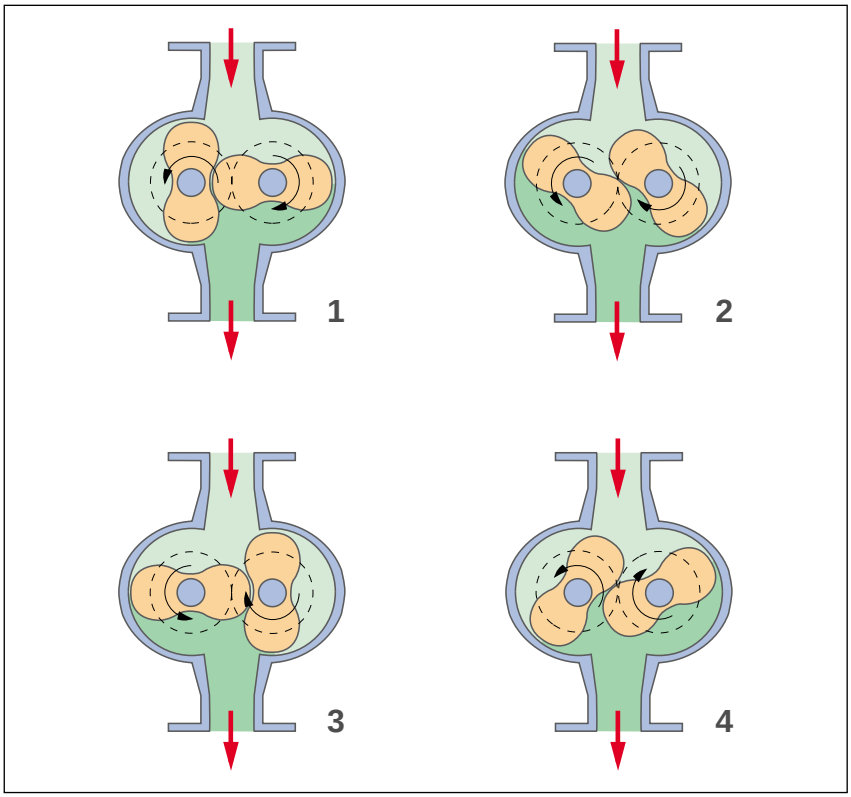
Set of pistons with their gear drive



Edition 01 - january 99

ROOTS pump operating principle

Operating principle



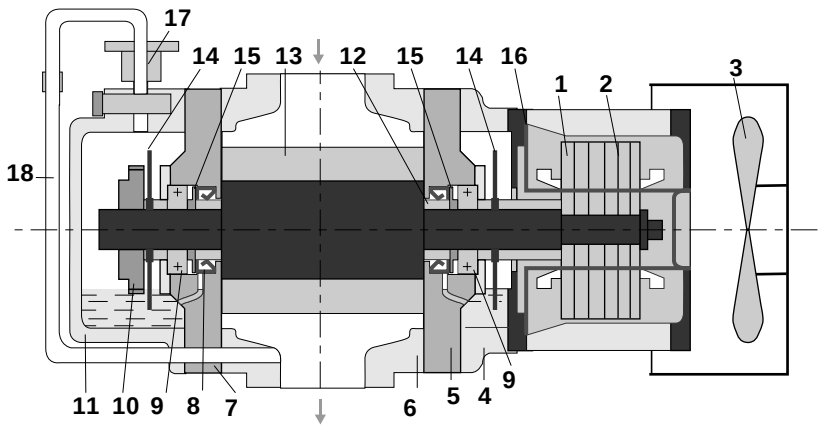
During the rotation, each rotor creates between itself and the stator a varying space, transfering the carried gas from the inlet to the exhaust without any internal compression and generating also the pumping effect.

As soon as the isolated volume (phase 3) is in communication with the exhaust pipe, the gas volume isolated at inlet pressure is «compressed» at exhaust pressure by the gas coming from exhaust circuit (phase 4). Then the rotors «push» the molecules outside (phase 1).

Edition 01 - january 99

ROOTS pump operating principle

Pump tightness



1. Motor stator
2. Motor rotor
3. Fan
4. Casing
5. End plate
6. Stator
7. End plate
8. Lip seal
9. Ball bearing
10. Gear wheel
11. Casing
12. Friction ring
13. Rotor
14. Splash
15. Deflector
16. Motor sleeve
17. Filter
18. Casing pumping tube

Inner tightness

The lubrication requirements of these machines are limited to the ball bearings and synchronisation gear train.
The two casings containing the oil are isolated from the pumping chamber by a sealing system (lip seal for dry friction in PTFE + treated friction ring + deflectors) which prevents any possibility of oil contamination of the pumped gases.

The oil casing are sealed from the pumping chamber by means of a link tube connecting the casings to the exhaust of the machine. This avoids the creation of any pressure difference between the pumping chamber and the casing which would otherwise stimulate to oil migration. An oil mist filter avoids any oil back-streaming into casing tubes.

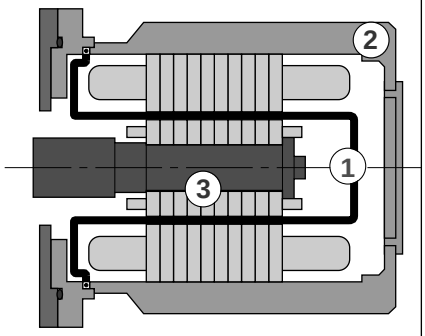
Edition 01 - January 99

ROOTS pump operating principle

Tightness at motor side (shaft passage)

The vacuum tightness is ensured by the motor design with built-in jacket (hermetically sealed).

This system provides total safety regarding leaks outside the pump and requires no maintenance.



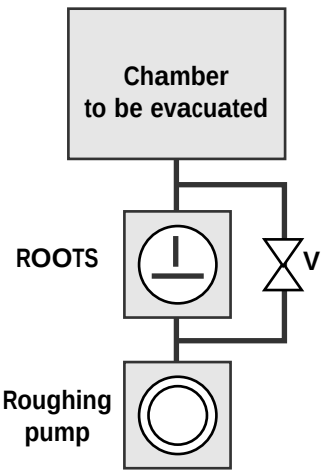
1 - Built-in jacket
2 - Motor housing
3 - Electrical rotor

Operating limits

Electrical power consumed by the pump is directly proportional to the difference between inlet and exhaust pressures (ΔP).

The real pumping flow and "ΔP" value are determining the absorbed power .

As a matter of fact, Roots pumps must be combined with other pumps in order to limit this ΔP.



For all operation with a pressure difference (ΔP) higher than the Roots performances (see characteristics table ***A 30***), use a pressure switch or a variator to make the pump start-up easier.

Operation with a pressure switch

The Roots can be automatically started-up using a pressure switch, as soon as the switching pressure required by the application is reached.
The pressure switch will stop the pump in case of important pressure increasing.

Operation with a variator

Electrical power of the Roots motor can be monitored by a variator according to the pumping conditions.
This allows the Roots to start at atmospheric pressure.

Edition 01 - january 99

Technical characteristics

Characteristics	Units	RSV 1002	RSV 1502
Pumping speed at 3000 rpm	m^3/h	1000	1500
Nominal flow-rate(1) at **50 Hz** at 3000 rpm Nominal flow-rate(1) at **60 Hz** at 3600 rpm	m^3/h (cfm)	660 (388) 800 (470)	940 (552) 1150 (676)
Rotation speed at **50 Hz** Rotation speed at **60 Hz**	rpm rpm	3000 3600	3000 3600
Total ultimate pressure(1)	Pa mbar	2.10^{-2} 2.10^{-4}	2.10^{-2} 2.10^{-4}
Partial ultimate pressure(1)	Pa mbar	5.10^{-3} 5.10^{-5}	5.10^{-3} 5.10^{-5}
Maximum differential pressure (Δ**P max.**)	Pa mbar	5.10^3 50	2.10^3 20
Maximum pressure at inlet in continuous operation(1)	Pa mbar	$1.4x10^3$ 14	300 3
Leak rate	mbar.l/s	$\leq 10^{-7}$	$\leq 10^{-7}$
Inlet flange	Pneurop	PN(2) or DN 100	PN(2) or DN 100
Exhaust flange	Pneurop	PN(2) or DN 100	PN(2) or DN 100
Motor power at **50 Hz** Motor power at **60 Hz**	kW kW	3.5 4	3.5 4
Supply voltage (3 Phases) at **50 Hz** LT coupling at **50 Hz** HT coupling at **60 Hz** LT coupling at **60 Hz** HT coupling	 V V V V	 200 / 240 380 / 415 200 / 240 380 / 480	 200 / 240 380 / 415 200 / 240 380 / 480
Oil capacity	l	2	2
Running ambient temperature	°C	5 to 40	5 to 40
Dimensions l x w x h	mm inch	970 x 364 x 363 39.4 x 14.4 x 14.3	1082 x 364 x 363 44.3 x 14.4 x 363
Weight	kg lbs	235 518	270 595

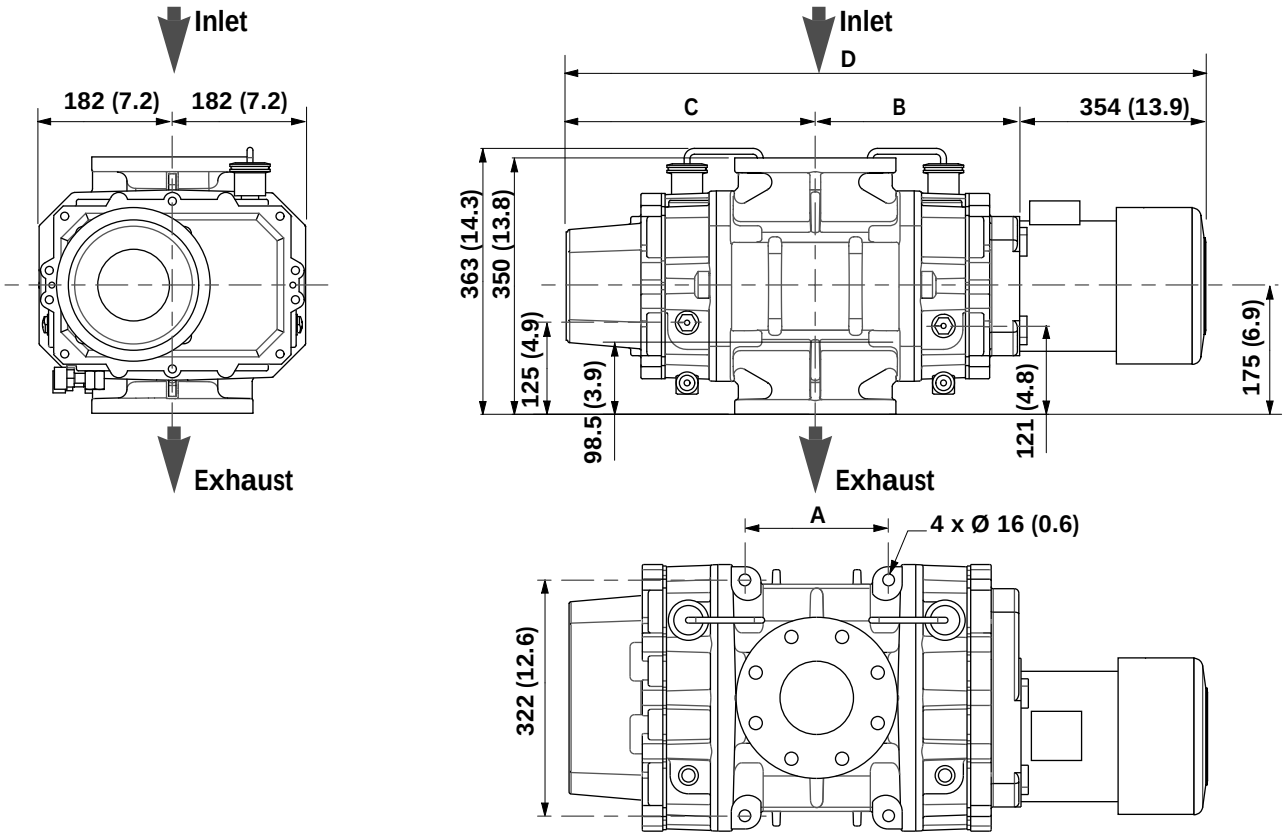
(1) - with a roughing pump 2100 (100 m^3/h, 50 Hz)

(2) - see accessoiries - PN : Petroleum standard according to ISO-2084

Edition 01 - january 99

Technical characteristics

Dimensions



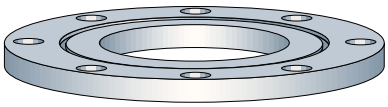
Dim. mm(inch)	A	B	C	D
Roots 1002	**196 (7.7)**	**276 (10.9)**	**340 (13.4)**	**970 (38.2)**
Roots 1502	**308 (12.1)**	**322 (12.6)**	**396 (15.6)**	**1082 (42.6)**

Edition 01 - january 99

Accessories

Weldable flange for tubing

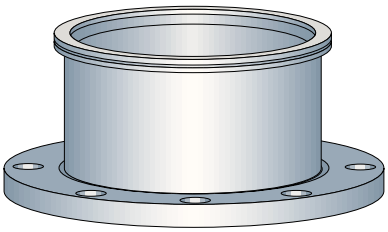
Fitting flange on wich a customer supplied tube will be welded.



Pump type	Fitting type	P/N
Roots 1002	**DN 100**	**102481**
	4 “	**102482**
Roots 1502	**DN 160**	**102484**
	6 “	**102485**

Adaptation flange

Fitting flange ISO outlet.



Pump type	Fitting type	P/N
Roots 1002	**DN 100**	**102483**
	DN 100 + DN 25 port	**107339**
Roots 1502	**DN 160**	**102486**
	DN 160 + DN 25 port	**107340**

Pressostat

Allows to close a contact when the pressure reaches the requested value.

Pressostat	Pressure range	Gauge P/N	Power unit P/N*
APS 3	**1 to 20 mbar**	**786423**	**053177**
APS 4	**35 to 200 mbar**	**786424**	**-**
APS 31	**3 to 65 mbar**	**786435**	**053177**

* Unit power supply: 220 V 50 Hz.

Variator

Allows to control the rotation speed of the motor in order to monitor its power according to the pumping conditions.

Example of variator: **UMV 4301 - LEROY SOMER**

Edition 01 - january 99

Safety instructions

Our ALCATEL products are designed and tested to provide the maximum safety. However, in order to obtain the best level of safety, the following instructions must be observed:
- the user manual during product transport, installation, operation and maintenance.
- the safety instructions bellow.

• The machines must be connected to an electrical installation in compliance with the decree 88-1056 dated 14 Novembre 1988.

• Our products are designed to comply with current EEC regulations. **Any modification of the product made by the user** is liable to lead non-compliance with the regulations, or even to put into doubt the EMC (ElectroMagnetic Compatibility) performance and the safety of the product. ALCATEL declines any responsability for such operations.

• Before any maintenance operation is perfomed by a maintenance technician who has not received safety training (EMC, electrical safety, chemical pollution, etc.), isolate the product from the various energy sources (electricity, compressed air, etc.).

• The EMC perfomance of the product is obtained on the condition that the installation complies with the EMC rules. In particular, in disturbed environments, **it is essential to**:
- use shielded cables and connections for interfaces,
- stabilize the power supply line with meshing from the power supply source to a distance of 3m from the product inlet.

• When switching off an item of equipment containing capacitors loaded with over 60VDC or 25 VAC, take precautions at the access to the connector pins (single-phase motors, fitting with mains filter, frequency converter, monitoring system, etc.).

• For all equipment handling, use the devices provided for this purpose (lifting rings, handle, etc.).

• The performance and the operational safety of this product are guaranteed provided that it is used in normal operating conditions.

Edition 01 - january 99

Safety instructions

• The vacuum pump is also a compressor: incorrect use may be dangerous. Study the user manual before commissioning the pump

• Remove the guards blocking the intake and exhaust (and if applicable, purge) holes; these components prevent foreign bodies from entering the pump during transport and storage.
It is dangerous to leave them on a pump in operation.

• Caution: the pumps are delivered without an oil load: the oil is found in separate drums. Similarly, it is recommended to drain the pump before redispatching the equipment.

• For machines which use lubricants, it is recommended to request the manufacturer for the safety data sheets concerning the product used.

• When inspecting the direction of rotation of the Roots pumps at installation, provide protection against the risk of compression related to the rotating machine on the intake.
Caution, a non-powered Roots can be driven by another pump in operation (risk of compression).

• Avoid moving a pump in operation.

• The machines are designed so as to prevent any thermal risk to the user's safety. However, specific operating conditions may generate on the pump, temperatures justifying particular attention on the part of the user (external surfaces > 70°C).
Hot surfaces which can cause serious burns when touched are signalled with specific label.

Hot surface

Hot surface near the label (pump body, exhaust tube…)

Edition 01 - january 99

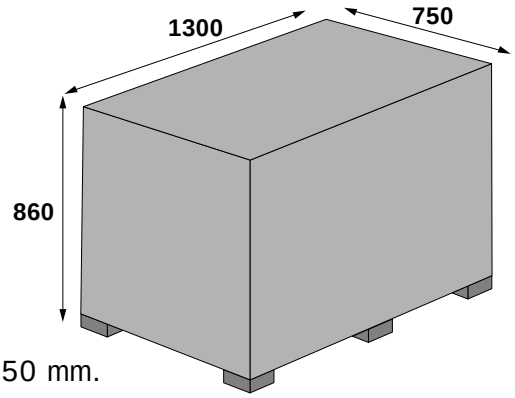
Unpacking / Storage

Handling

Precautions

If the equipment has been damaged, take necessary steps with the carrier and inform Alcatel, if necessary.
In all cases, Alcatel recommends that the packaging be saved, in the event that the equipment must be transported or put into prolonged storage.

Packaging dimensions



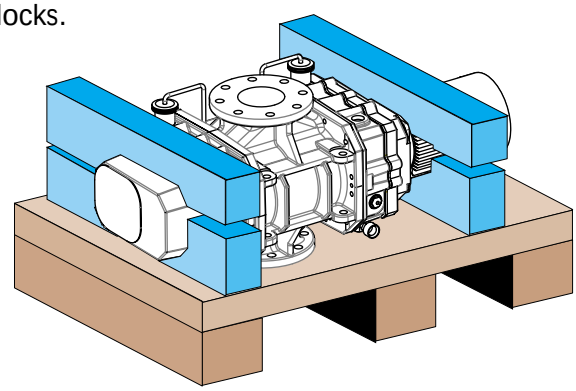
Tolerance: ± 50 mm.

Unpacking

Unscrew the fixing screws of the outer crate cover.

Remove the foam blocks.

Remove the fixing screws of the inner crate cover.



Edition 01 - january 99

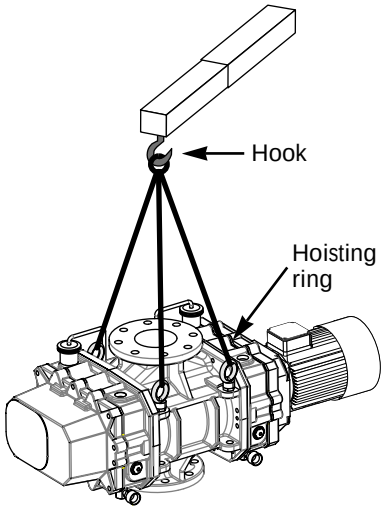
Unpacking / Storage

For all equipment handling, use the devices provided for this purpose (lifting rings, handle, etc.).

Remove the pump from the crate

It is highly recommended to use a hoist.
Fit the pump with the hoisting rings.
Lift the pump using the rings and remove the foam blocks.

Pump	Weight in kg (lbs)
Roots 1002	235 (518)
Roots 1502	270 (595)



Equipment storage

If the pump is going to be put into storage, the inlet and exhaust seals should be left in place.
Our equipment can be stored without particular storage precautions during 3 months (ambient temperature between 5 and 40 °C).
After 6 months, factors such as temperature, degree of humidity, salt air… may cause the deterioration of the pump components (elastomers, lubricants…).

Edition 01 - january 99

Positioning the pump in the pumping installation

⚠ Pump performance will depend on the kind of accessories used and the quality of the mechanical connections such as the pump fittings.

When assembling the vacuum circuit, we recommend the installation of maintenance accessories such as shut-off valves on the inlet and purge lines.

For safety reasons, use accessories on the inlet and exhaust lines whose materials and sealing properties are compatible with the gases being used.

Positioning the pump

Determine where the pump will be placed.

Review to the dimensions according to the models before installation (***see A 30***).

Use a hoist to handle the pump, lifting it by the hoisting rings.

The pump can be fixed to a frame using the 4 holes Ø 16 mm which are located in stator lateral sides.

The pump will be connected to the pumping circuit which must be equipped with a rough pumping system.

When connecting the hoses, be sure that the flanges are aligned and **there is no stress on the pump**. Once the hoses have been connected, they must not exert any stress on the Roots pump.

Temperature variations in particular must be avoided because they increase stress on the pump.

⚠ Make sure that any vacuum accessories connected to the inlet of the pumps withstand a negative pressure of 1 bar with reference to the atmospheric pressure.

Edition 01 - january 99

Filling the machine oil housings

Caution ! The pumps are delivered without an oil charge: the oil is found in separate containers.
Similarly, it is recommended to drain the pump before returning the equipment.

For machines which use lubricants, it is recommended to request for the safety data sheets from the manufacturer.

The pump is tested using mineral fluid Alcatel 120.

For a pump operation in clean process conditions, we recommend mineral fluid Alcatel 120.

For corrosive gases pumping, we recommend synthetic fluid Alcatel 113.
For any other application, please contact Alcatel.

Mineral and synthetic oils cannot be used together. Contact Alcatel or your service agent before making any changes.

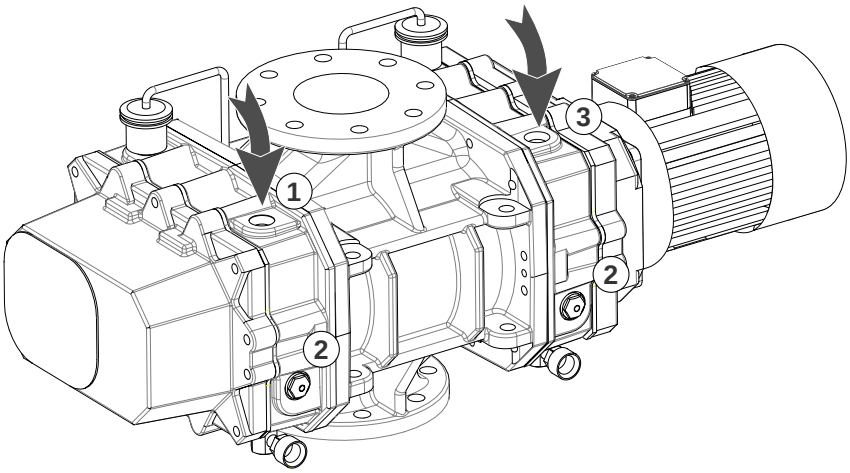
Oil quantities

Oil filling:				
Housings:	**Motor side**	**Gear box side**	**Total capacity**	**Nber of cans**
Roots 1002	0,7 l	1,3 l	2 l	***see D 20***
Roots 1502	0,7 l	1,3 l	2 l	***see D 20***

Edition 01 - january 99

Filling the machine oil housings

Filling procedure



Remove the fill plug on gear wheel casing (**1**).
Position the funnel in the oil filler neck.
Fill the pump with oil as long as **the oil level is in the middle of the sight glass (2).**
For this to be accurate, wait a few minutes for the oil to settle over all internal surfaces.
Do not exceed the recommended quantities (***see page 1/2***).
Reset the fill plug securely.

Repeat this operation for filling the motor side casing (**3**).

Edition 01 - january 99

Power supply connection

Study the preliminary precautions ***(see B 10)***

Motor characteristics, connection, protection

The information below is given as a recommendation.
The user must comply with the electrical standards or recommendations (IEC, VDE, UL, CSA, etc.) applicable in the country in which the pump is used.
The use of electrical protection for the pump motor makes it possible to protect:
- The motor: in the event of excess voltage or rotor blocking, the resulting excess current may destroy the coil and possibly the start-up system.
- The pump, in the event of increased resistance.

Never protect a three-phase motor with fuses not equipped with a differential system: if three phase motors are powered on 2 phases without a differential system, the motor could burn.

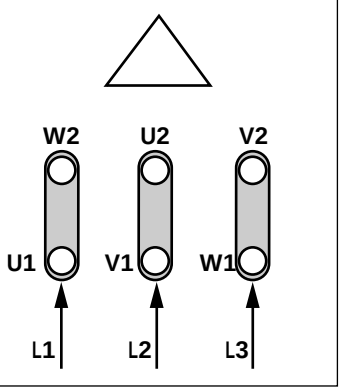
Three-phase motor

Electrical connections

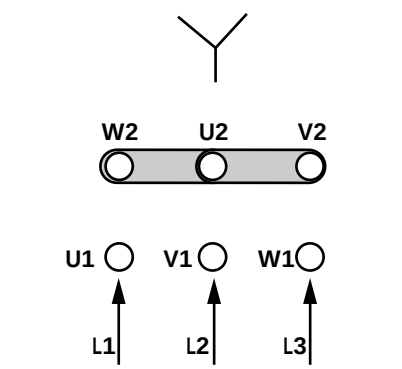
The pumps are equipped with 6 wires terminal box motors, the wiring diagram of the terminals is given as a rough guide only. In the event of doubt, only the plate in the terminal box should be used as a reference.

Terminal box (6 wires)

Low voltage connection



High voltage connection



Edition 01 - january 99

Power supply connection

Electrical protection circuit breakers rating

According to installation configuration:
• Operation of the Roots with a pressure switch, set to avoid the Roots start-up with a pressure difference between inlet and exhaust higher than the recommended one, use:
- a thermal motor breaker type D with the following protection ratings: LT 16A HT 10A.
- cables with wires of 2,5 mm^2 section
• Direct connection: in this case, during a short while, start-up current may be high, it is necessary to monitor the thermal safety of the motor and to use :
- a thermal motor breaker type D with the following protection ratings: LT 25A HT 16A.
- cables with wires of 4 mm^2 section
• Connection with a variator: monitor the thermal safety of the motor and refer to the delivered variator documentation.

⚠ In the case of a pumping in which the Roots is used at slow speed for a long time, it can be necessary to connect the fan to a power source independent from the variator to ensure the Roots cooling in any operation condition.

Internal thermal protection

Pump motors are equipped with a heat-protective thermistor device known as the “Stoptherme”. Located in the middle of the windings, this thermistor is always at the temperature of coils and immediately signals any dangerous overheating.

This deflector in the form of a bimetallic disc can do the following:
- actuate the motor control switch;
- trigger a visible or audible signal.
The“stoptherme” circuit is an independent circuit consisting of a switch which is opened when the internal coil temperature is below 150 °C ± 5 °C.
The maximum line voltage is 250 V 50 Hz, with a maximum operating current of 2.5 A at 50 Hz.
The three-phase motor is normally controlled by a switch in series with the “stoptherme” protective circuit.

Variator protection

Refer to the delivered variator documentation.

Edition 01 - january 99

Checking the direction of rotation and initial pump start-up

Study the preliminary precautions *(see B 10).*

• Check that the mechanical and electrical connections defined in the chapter B have been made.
• Before each pump start up, check that oil level housings appear in the middle of the sight glass: do this check with the pump stopped.
• Remove the guards blocking the intake and exhaust holes; these components prevent foreign bodies from entering the pump during transport and storage. It is dangerous to leave them on a pump in operation.

Check the direction of rotation at initial pump start-up

When inspecting the direction of rotation of the Roots at the initial start-up, provide protection against the risk of compression related to the rotating parts in the inlet.
Caution ! A non-powered Roots can be driven by another pump in rotation (risk of compression) .

Remove the blank-off flange on the inlet and exhaust port.

Fit a pressure gauge at the pump inlet.

Start-up the pump and stop it after few seconds:
- if the pressure indicated is less than 50 Pa, the rotational direction is correct.
- if the pressure increases, **invert two phases at main switch terminal** (***see B 50***).

Before any service intervention on electrical circuit, make sure that the electrical source has been disconnected to the pump.

Note : Rotation can also be checked at the exhaust by making sure gas is being forced out of the exhaust flange.

Edition 01 - january 99

Roots operation

Preliminary precautions

⚠ • The performance and operating safety of this product can only be guaranteed if it is operated according to normal conditions of use.
• The vacuum pump is also a compressor: incorrect operation may be dangerous. Study the user manual before starting up the pump.
• The pumps are designed to prevent any thermal risk for user safety. However, specific operating conditions may generate temperatures which may justify particular attention on the part of the user > 70°C).
• Product tightness is guaranteed for normal operating conditions when the product leaves the factory. It is the user's responsibility to maintain the level of tightness particularly when pumping dangerous products.

⚠ Check that the exhaust orifice is not blocked.

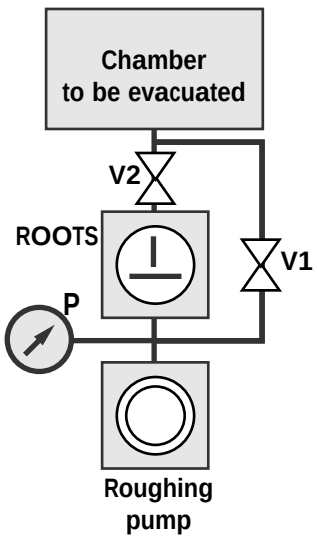
Example of operation

Machines not fitted with variator can not be started up until the roughing pump has brought the chamber pressure down to the permissible start-up pressure.
This pressure will depend on the flow rate ratio between the roughing pump and the Roots vacuum booster and the maximum permissible pressure difference ΔP.

The pump is fitted with a pressure switch

During the first pumping phase from atmospheric pressure to P, switching-on pressure, the Roots is stopped and the primary pump is pumping through the valve V1.
As soon as the switching pressure of the pressure switch is reached, the valve V1 is closed,
V2 opens and the Roots starts up.

In case of sudden pressure increasing, the pressure switch isolates the Roots by closing the isolating valve (V2).



The pump is fitted with a variator

V1 and V2 valves are open. The rotation speed of the pump, monitored by the variator, is in inverse proportion to ΔP. The Roots reaches its nominal rotation speed and its maximum pumping speed as soon as the maximum authorized ΔP is reached.
In the same pumping conditions, the requested chamber pressure is reached quicker.

Edition 01 - january 99

Safety instruction related to maintenance

This chapter describes the main preventive maintenance operations and provides a guide for first diagnosis in the event of an incident.

⚠ Standard precautions before any maintenance operation: Before performing a maintenance operation, switch off the pump by disconnect the mains cable.

⚠ CAUTION: before any operation, check the pumping conditions of the installation: toxicity, corrosion, possible radioactivity of the pumped gases.

⚠ Product tightness is guaranteed upon leaving the factory for normal operating conditions.
It is the responsibility of the user to ensure that the level of tightness is maintained when pumping dangerous gases.

Recommandations

Purge the installation with dry nitrogen.

To wear gloves, protective glasses and, if necessary, a breathing mask.

To ventilate the premises well.

Not to dispose of residue but, if necessary, to have it destroyed by a qualified organization.

Certain gases can become corrosives and toxic when trapped in oil. Always wear protective gloves when handling used and dirty pump oil, drain it into a closable container, and do not breathe the fumes of the oil. Always use fully self-contained breathing apparatus.

Always dispose of used dirty oil, or sub-products properly and in compliance with all local, state and federal environmental laws and regulations.

⚠ After a complete maintenance operation, on the pump or on the installation, it is recommended to perform a tightness test with helium.

Edition 01 - january 99

Maintenance frequency

Each pumping case is a particular one.
For this reason, the frequency of oil replacement will be adapted according to the applications.

For information, typical maintenance periodicities are the following:

	Description	Delay	Time required
Partial maintenance	**Draining of pump used on clean application**	**8 500 h**	**1 h**
Total maintenance	**Pump used on clean application**	**26 000 h**	**12 h**
	Pump used on harsh application	**17 000 h**	**12 h**

Equipment required

Description	**P/N**	**Specific tool**	**Comments**
Major kit	**107341**	Consult us	
Oil Alcatel 120 (2 l)	**068099**		1 oil filling (***voir B 40***)
Fluid Alcatel 113 (0,5 l)	**064657**		4 oil fillings (***voir B 40***)

Edition 01 - january 99

Diagnosis and troubleshooting

INCIDENT	CAUSE	TROUBLESHOOTING
The pump is not running	**Incorrect motor power supply**	Check the power supply.
	NO	
	Pump seized	Call Alcatel customer service.
	NO	
	Other problem	Call Alcatel customer service.
No pressure decreasing, pump running	**Incorrect direction of motor rotation**	Rewire (***see B 50***).
	NO	
	Insufficient motor power	Check the power supply.
	NO	
	Limit pressure obtained is not low enough	• Check the rating of rough pumping unit. • Check that exhaust is not clogged.
	NO	
	Other problem	Call Alcatel customer service.

Edition 01 - january 99

Diagnosis and troubleshooting

INCIDENT	CAUSE	TROUBLESHOOTING
Pump too hot	**Ambient temperature too high**	Check the installation.
	NO	
	Pump placed in a poorly ventilated place	Check the installation.
	NO	
	Vents blocked	Check the installation.
	NO	
	Operation at high pressure	ΔP too high.
	NO	
	Motor in over-voltage or in short-circuit	Check the voltage, replace the motor.
	NO	
	Other problem	Call Alcatel customer service.
Oil presence in the exhaust	**Oil level too high**	• Drain and fill with new oil (***see E 10***).
	NO	
	Internal pump tightness	Call Alcatel customer service.
Oil losses in the housings	**Leak in the housings**	Check the draining plugs.
	NO	
	Internal pump tightness	Call Alcatel customer service.

Edition 01 - january 99

ROOTS pump draining

Study the safety precautions before intervention.
(see D 10)

Certain gases become corrosive and toxic when trapped in oil. Aways wear protective gloves when handling used and dirty pump oil, drain into a closable container, and do not breathe the fumes of the oil.
Always use fully self-contained breathing apparatus.

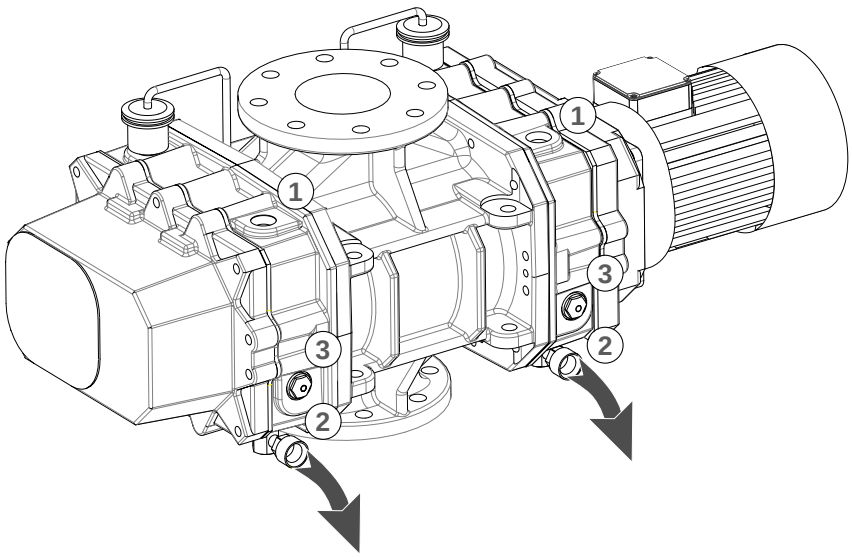
Always dispose of used or dirty oil, or sub-products properly and in compliance with all local, state and federal environnemental laws and regulations.

Housing oil replacement

Unfasten the fill plug **(1)** in order to eliminate any excess pressure in the housing.

10

Remove the drain plug **(2)** and allow the used oil to flow into a container (provide a capacity of 2 litres).



Caution: the Roots is equipped with 2 housings.
Repeat the operation for each housing.

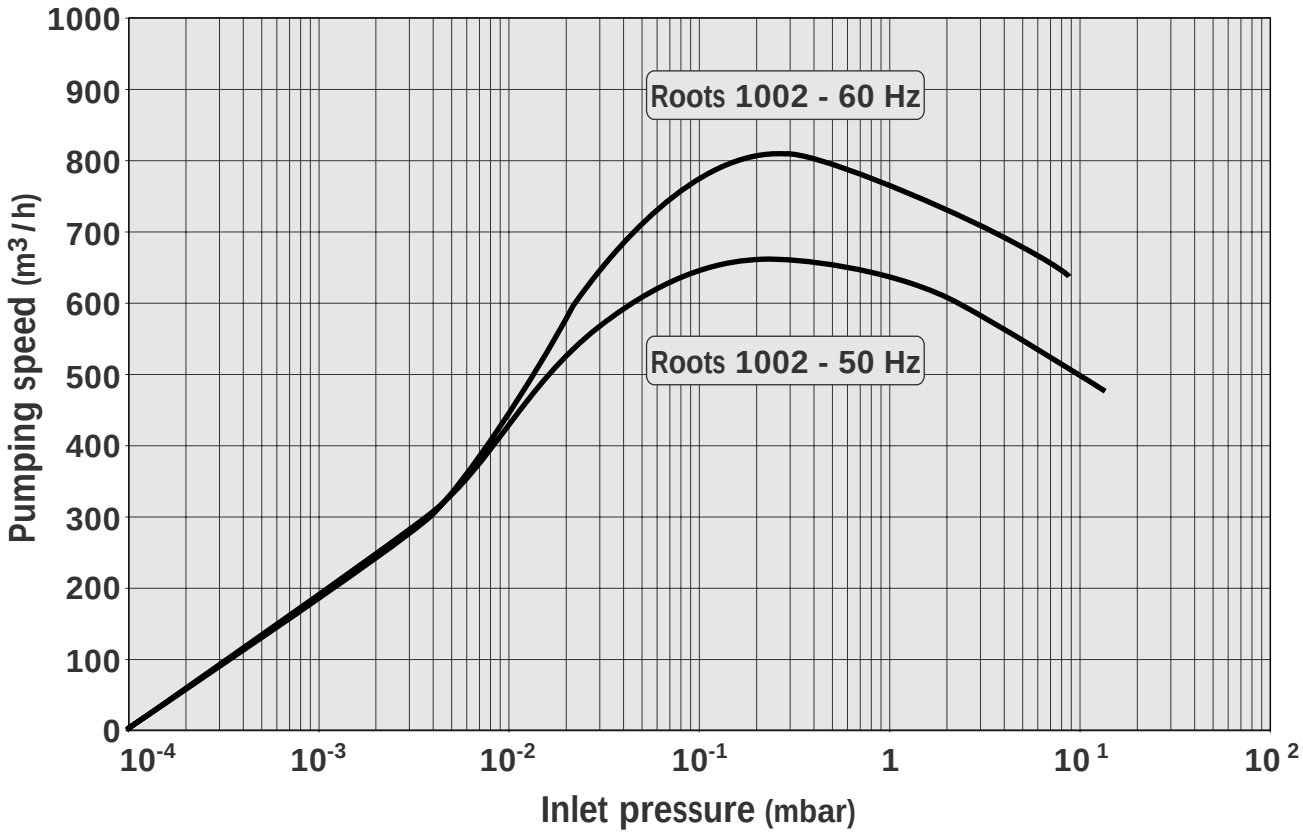
Replace the drain plug and then remove the fill plug.

Introduce the quantity of new oil required ***(see B 40).***

Edition 01 - january 99

Pumping curves

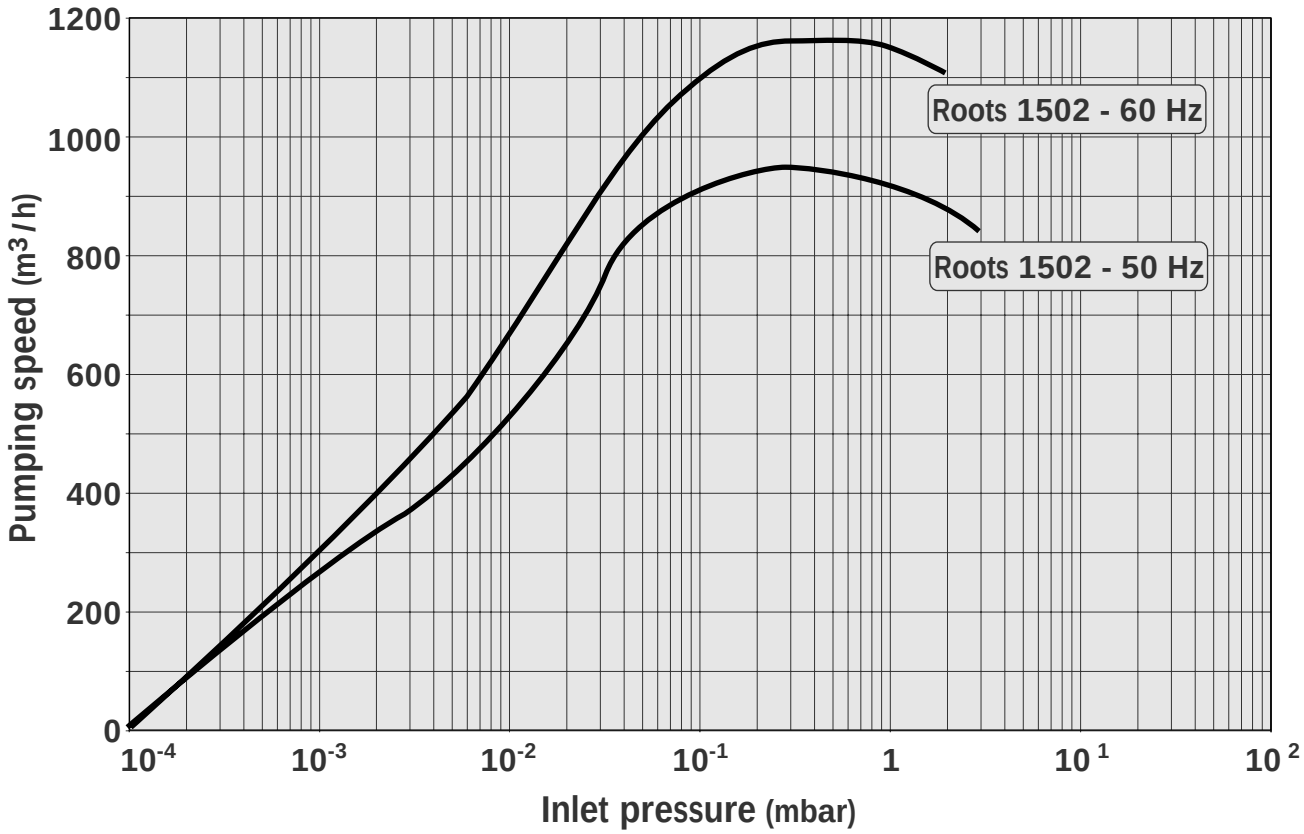
Pumping speed
Roots 1002 **With a rough mechanical pump 2100.**



Edition 01 - january 99

Pumping curves

Pumping speed
Roots 1502 **With a rough mechanical pump 2100.**



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Publication : Alcatel - Realization : D.O.C. 74 - (33) (0)4 50 64 14 74 - Part Number : 107342 - Ed.01 - 01/1999

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